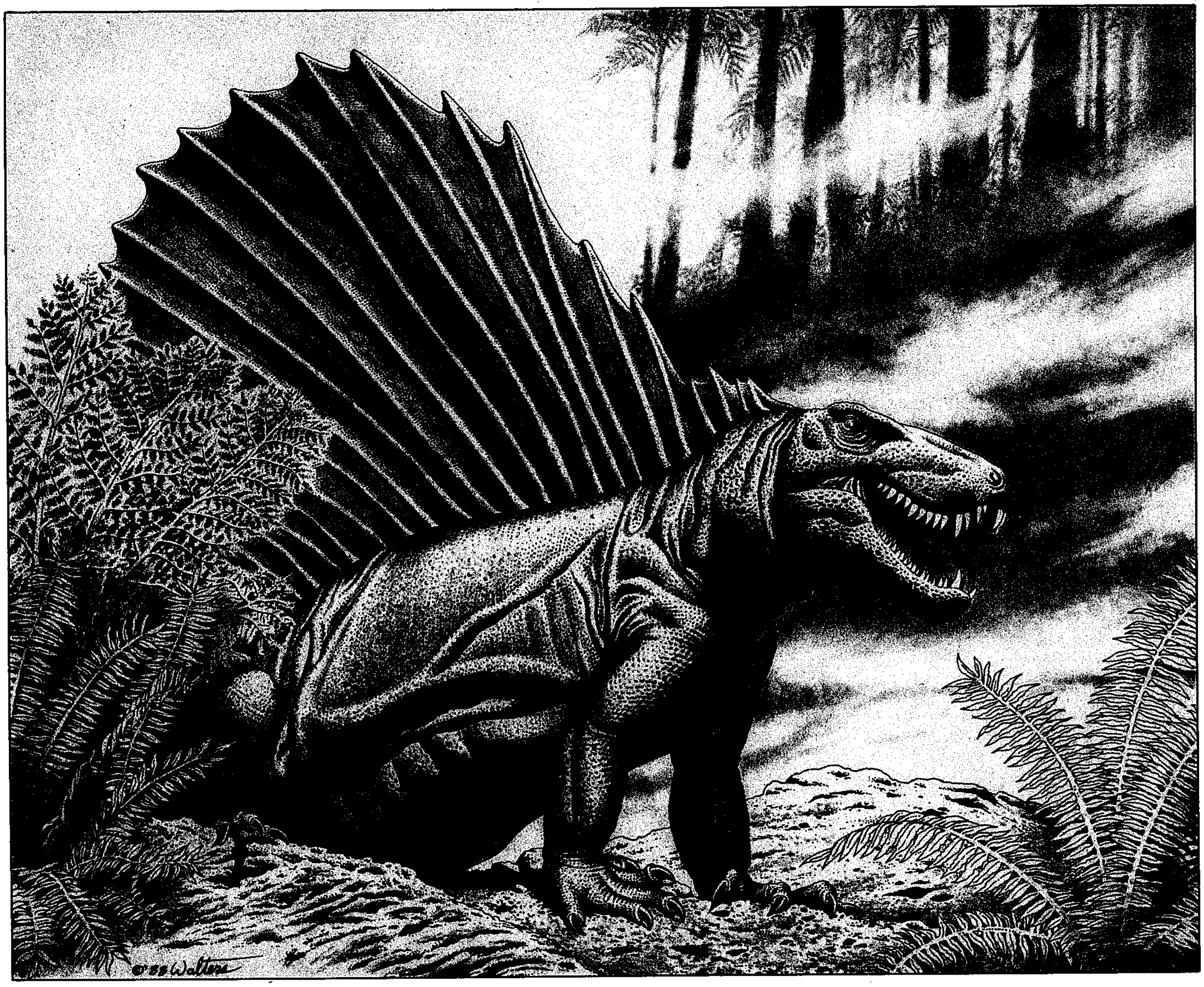
THE MOSASAUR



THE JOURNAL OF
THE DELAWARE VALLEY
PALEONTOLOGICAL SOCIETY

VOLUME IV OCTOBER, 1989

The Mosasaur

The Journal of the Delaware Valley Paleontological Society

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Rediscovery of Fossil Material at the Academy of Natural Sciences of Philadelphia from Edward Drinker Cope's 1893 Expedition to the Dakotas

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Abstract

The authors recently rediscovered an uncatalogued cache of fossil reptile material in the vertebrate paleontology collection at the Academy of Natural Sciences of Philadelphia. Evidence suggests that these were part of the collection made by Edward Drinker Cope on his expedition to the Dakotas and Oklahoma in 1893. The collection was made in the vicinity of Fort Yates, North Dakota, and Hump Creek, South Dakota, and was predominantly from the Hell Creek Formation of Maastrichtian age.

The vertebrate paleontology collection at the Academy of Natural Sciences of Philadelphia contains over 18,000 lots, any dating from the early days of vertebrate paleontology in orth America. Thomas Jefferson, R. Harlan, F. V. Hayden, E. Cope, and Joseph Leidy, among others, have contributed to is collection. These specimens hold great historical, as well as ientific interest. We report here on additional specimens of storical interest that were discovered in the Academy's collecon: an uncatalogued lot of reptile fossils collected by Edward inker Cope on his 1893 expedition to the Dakotas and Ok- homa.

Cope studied vertebrate paleontology at the Academy during e last decades of the 19th Century. The vertebrate paleontol- y collection contains numerous fossil mammals, turtles, and hes that Cope described. Although he was located in Philadel- ia for much of his career, his extensive collection of fossil hosaur material was bought by the American Museum of atural History from his estate in 1899. The rediscovery of aterial from his 1893 expedition is of special interest because the historical impact that Cope had on the Academy and on e science of vertebrate paleontology in general. As such, this d represents a piece of Academy history that had been lost, d provides a glimpse of the past for historians of science. It is also a sample of specimens from the Late Cretaceous of North Dakota, a time and place not previously represented in the Academy's collection.

Why these specimens were at the Academy and left uncurated is not known. Recent curators at the Academy were apparently aware of their existence but not their significance, and nothing was done with them. Many of the specimens were still wrapped in *The Fargo Forum* and the *Sioux County Herald* newspapers dated 1893. Several of the wrappings were labeled with collection dates in late July and early August of that year (Figure 1). Some packages also gave a rough idea of the locality and contents. From these clues we were able to surmise that this was indeed material from the E. D. Cope expedition of 1893. The writing on the newspaper was verified to be Cope's by Dr. Ronald Rainger (personal communication).

Cope's expedition to the Dakotas and Oklahoma in 1893 spent several weeks in the vicinity of Fort Yates, North Dakota (Osborn, 1931). The newly discovered specimens were apparently collected in this area. Osborn also reproduced several letters written by Cope to his family during this trip. In a letter of July 25, 1893, from near Fort Yates, Cope wrote: "It looks like as if we had gotten into the right region for the Laramie saurians. I have now good representatives of the *Hadrosaurus* type of the

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Figure 1. E. D. Cope's handwritten note on newspaper-wrapped package of fossil material. Caption reads, "2 of [?] bluffs, 8 miles W. of Fort Yates N.D., 7-20-93."

Laramie; but the other herbivorous family of the Agathaumidae and the Megalosauridae (carnivorous) I have only in fragments." On the 29th he added: "There are particularly more remains of the horned Agathaumidae (a triceratopsian) which I have been especially anxious to get." Back in Fort Yates on the 10th of August he wrote: "We came in the day before yesterday with our load of 1500 lbs. of fossils, and have everything ready for shipment to Bismarck, so soon as a boat shall arrive." The handwritten dates on many of the newspaper wrappings indicate localities "8 miles west of Fort Yates" or "first bluff Hump Creek."

With the help of Dr. R. Rainger we have located a group of letters in the Academy's archives written by Cope to Isaac Wistar at the Academy during the time that Cope was on this expedition. The following is one of the more informative letters, reproduced here in its entirety (Library of the Academy of Natural Sciences, Manuscript Collection 567, no. 10):

> Rock Creek Subagency
> S. Dakota 8-3-1893
>
> Dear Genl. Wistar,
>
> Your dispatch and letter was received. On getting the former I at once hired a team + went south from Fort Yates to the Grand R. + secured an Indian guide + went from Grand R. to Hump Creek + up Hump Creek say six miles, + camped. Hump Creek enters the Grand about 40 miles west of its mouth. We found considerable badlands, and for about 3/4 of a mile, the Laramie beds contained many vertebrate fossils, but in a broken condition. We however dug out a good many good bones, and found some valuable fragments on the surface. Together we have filled a very large box, two large boxes, and two smaller ones, altogether not less than 1500 lbs.--perhaps more. We got nothing complete but probably 15 species of extinct reptiles are represented, many of them of gigantic size. Several specimens of the horned Agathaumidae were found, but no complete head.
>
> We had the misfortune to have our horses run off through the carelessness of the driver, who also on one occasion turned the wagon upside down! We had to hire an Indian team and by great good fortune got in here last night. This place is 15 miles down Grand R. from our camp. We were in camp a week, had mostly good weather, only one violent thunder storm having struck us.
>
> We are now going to another badland region and hope to get a guide tomorrow. From all that I hear we should have good success at our new ground.
>
> Col. Comba who is in command at Fort Yates told me that they had plenty of transportation to spare, appearances certainly justified his assertion. One of the captains told me the same. The objections of the Secretary of war were based on some other reasons than those he gave, I strongly suspect.
>
> Very truly yours,
> Edw. D. Cope

The last paragraph of this letter offers fodder for speculation that Cope's suspicions about the objects of the Secretary of War were related to his feud with O. C. Marsh. Unfortunately Cope was not specific enough for us to know exactly what he meant. It is also possible that the military authorities did not want to encourage expeditions into this area because of delicate relations with the native Americans.

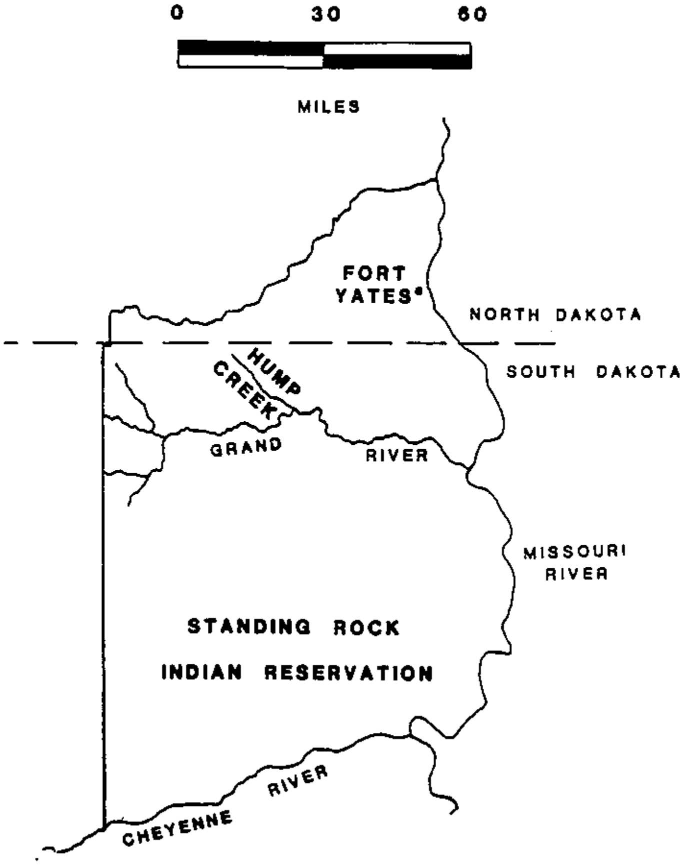


Figure 2. Generalized map of the Standing Rock Indian Reservation in south-central North Dakota and north-central South Dakota along the Missouri River. The region in which E. D. Cope is most likely to have collected the material discussed in this report is in the vicinity of Fort Yates and Hump Creek.

Although the geographic region where Cope collected this material is well pinned down (Figure 2), information on which formations he collected in is wanting. Fortunately, the general stratigraphic setting for the region around Fort Yates, North Dakota, and Hump Creek, South Dakota, is reasonably straightforward (e.g., Clayton et al., 1980). The oldest lithologic units are to the east, and they become progressively younger as one moves to the west. The marine Pierre Formation is exposed to the east along the Missouri River, and into the Grand River drainage. Overlying this unit is the Fox Hills Formation, a near-shore marine unit. The Fox Hills Formation is in turn overlain by the terrestrial Hell Creek Formation. The Hell Creek is dominantly a fluviatile unit with a complex sedimentological history (e.g., Archibald, 1982; Fastovsky and Dott, 1986). In addition to the complex of channel facies preserved in this formation, numerous fossil soil horizons are also recognized (Fastovsky & McSweeney, 1987; Retallack & Spoon, 1987).

The Hell Creek Formation has been extensively studied further to the west in McCone County, Montana, and has been typically considered to be Maastrichtian in age, with the Cretaceous-Tertiary boundary being coincident with the lithologic contact between the Hell Creek and the overlying Tullock Formation (e.g., Archibald, 1982; Fastovsky, 1987). Alternatively, some workers are placing the Cretaceous-Tertiary boundary within the Hell Creek Formation and referring to the upper Hell Creek as Paleocene in age (Rigby et al., 1987). Although the precise position of this boundary is not the focus of this discussion, the authors here interpret the Hell Creek in the Fort Yates area in the more traditional view, and the collection of fossils discussed here is inferred to be Maastrichtian in age.

Overlying the Hell Creek in this region is the Ludlow Formation, a fluvial unit, and overlying the Ludlow is the marine Cannonball Formation. In McCone County, Montana, the Hell Creek is overlain by the Tullock Formation, which is considered by some workers to be the lithologic equivalent of the Ludlow (e.g., Fastovsky, 1987).

The faunal remains from Cope's 1893 expedition rediscovered in the Academy's holdings are probably only a portion of the material from this area since Cope refers to 1500 pounds of specimens in his correspondence. The new collection consists of approximately 180 specimens, of which about 35 percent are identifiable. Virtually all of the identifiable material is fragmentary, with complete elements being rare.

A reasonably diverse fauna is recognized (Table 1; Figures 3, 4). Most of this material is interpreted to be from the Hell Creek Formation. It seems likely, and given the correspondence from Cope while he was in the field and the notations made on the field wrappings, that this material came from several sites. Differences in preservation of the bones also suggests more than one locality; in fact, some may not have been collected within the Hell Creek Formation at all. For example, a plesiosaur vertebra (Figure 3D) and ammonite were probably picked up in the Pierre Formation which crops out in some of the washes that Cope's group undoubtedly followed. Certainly it is not impossible for plesiosaur remains to come from terrestrial units. Rare occurrences of plesiosaur remains have been reported from the terrestrial Judith River Formation of southern Alberta (Dodson, 1983).

Table 1

Invertebrate Fauna

- Order Ammonoidea
  - Family Scaphitidae
    - *Scaphites* sp., cf. *S. nicolletii*

Vertebrate Fauna

- Order Chelonia
  - Family Trionychidae
    - *Aspideretes* sp.
  - Family Baenidae, undet.
- Order Crocodylia
  - Family Crocodylidae, undet.
- Order Choristera
  - Family Champsosauridae
    - *Champsosaurus* sp.
- Order Plesiosauria, undet.
- Order Saurischia
  - cf. Family Ornithomimidae
- Order Ornithischia
  - Family Hadrosauridae
    - cf. *Edmontosaurus* sp.
  - Family Ceratopidae
    - cf. *Triceratops* sp.

In summary, the authors have recently rediscovered a set of uncatalogued vertebrate fossils in the Academy's vertebrate paleontology collection. Based on handwritten notes on the newspaper wrappings, and the correspondences from Edward Drinker Cope, we are confident that they represent a previously unrecognized, historically interesting, collection of vertebrate fossils taken largely from the Hell Creek Formation by Cope on his expedition to the Dakotas in 1893.

Acknowledgements

The authors would like to acknowledge the Library of the Academy of Natural Sciences of Philadelphia for permission to quote from Cope's correspondence. Our thanks go to Dr. Ronald Rainger for his help, and to Earle Spamer for making suggestions on the manuscript. Thanks also to Donald Baird and David Parris for their useful reviews of the manuscript.

References Cited

ARCHIBALD, J. D. 1982. A study of Mammalia and geology across the Cretaceous-Tertiary boundary in Garfield County, Montana. *University of California Publications in Geological Science*, 122:1-286.

CLAYTON, L., S. R. MORAN, J. P. BLUEMLE, & C. G. CARLSON. 1980. *Geologic map of North Dakota*. U.S. Geological Survey, scale 1:500,000.

DODSON, P. 1983. A faunal review of the Judith River (Oldman) Formation, Dinosaur Provincial Park, Alberta. *The Mosasaur*, 1:89-118.

FASTOVSKY, D. E. 1987. Paleoenvironments of vertebrate-bearing strata during the Cretaceous-Paleogene transition, eastern Montana and western North Dakota. *Palaios*, 2:282-295.

FASTOVSKY, D. E., & R. H. DOTT, Jr. 1986. Sedimentology, stratigraphy, and extinctions during the Cretaceous-Paleogene transition at Bug Creek, Montana. *Geology*, 14:279-282.

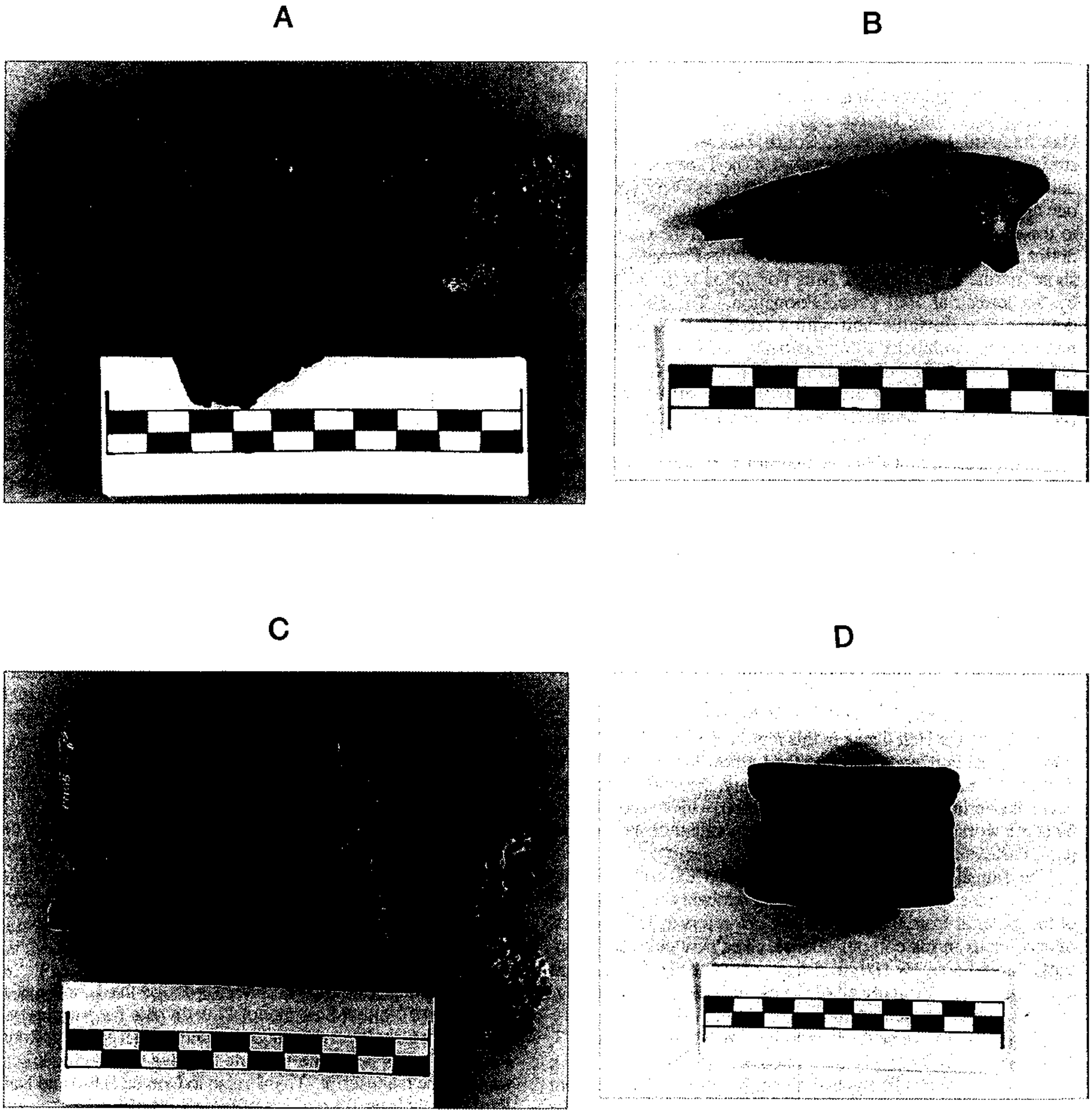
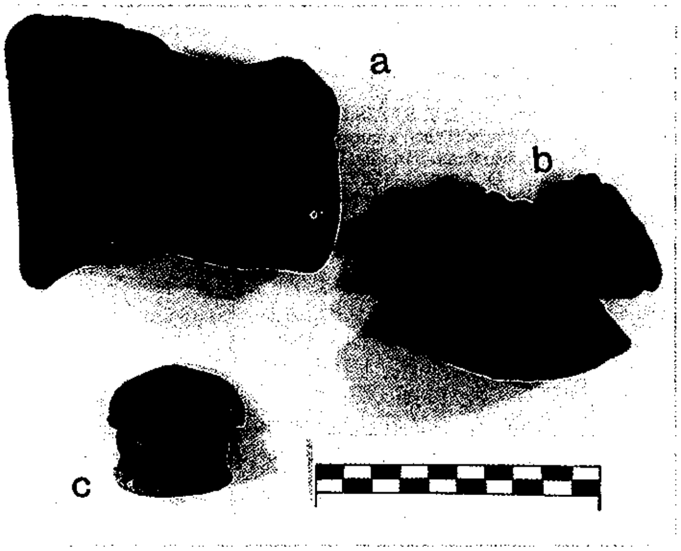


Figure 3. Selected non-dinosaurian reptile remains collected by E. D. Cope in 1893. **A,** Baenid plastron fragment (ANSP 17093). **B,** Turtle(?) ungual (ANSP 17098). **C,** Crocodile scutes and jaw fragments (ANSP 17105) and crococile tooth (ANSP 17105). **D,** Plesiosaur centrum (ANSP 17097). Scale bars are 10 cm.

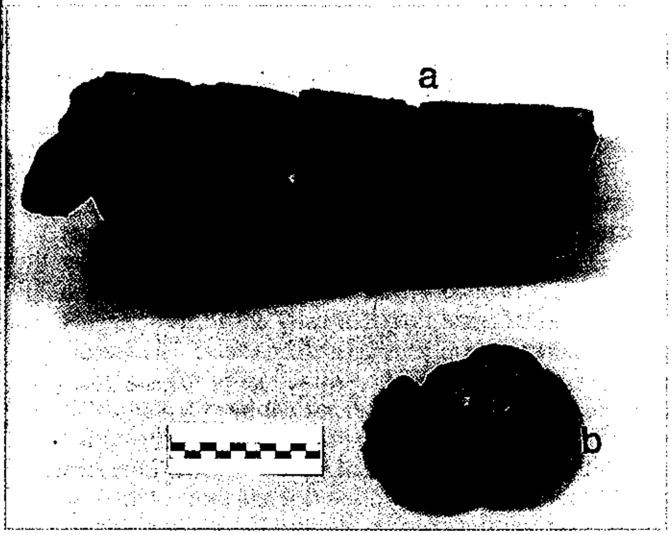
(Facing page.) **Figure 4.** Selected dinosaurian remains collected by E. D. Cope in 1893. **A,** Hadrosaur jaw fragment (ANSP 17109), cf. *Edmontosaurus* sp. **B(a),** Partial hadrosaur phalanx (ANSP 17101). **B(b),** Hadrosaur ungual (ANSP 17100). **B(c),** Ceratopsian(?) ungual (ANSP 17099). **C(a),** Ceratopsian orbital horn core, cf. *Triceratops* sp. (ANSP 17094). **C(b),** Ceratopsian occipital condyle, cf. *Triceratops* sp. (ANSP 17095). **D,** Ceratopsian frill fragment, cf. *Triceratops* sp. (ANSP 17108). **E,** Ornithomimid phalanx (ANSP 17096). Scale bars are 10 cm.

A

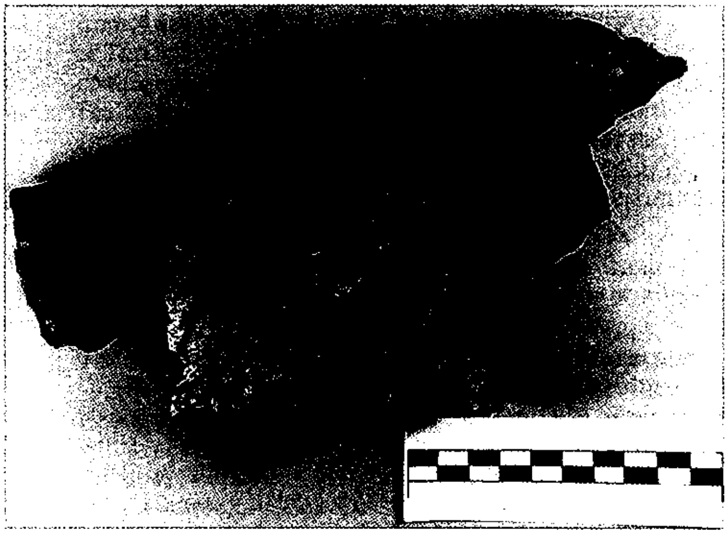
B



C



D



E

FASTOVSKY, D. E., & B. K. MCSWEENEY. 1987. Paleosols spanning the Cretaceous-Paleogene transition, eastern Montana and western North Dakota. *Geological Society of America Bulletin*, 99:66-77.

OSBORN, Henry F. 1931. *Cope: Master naturalist.* Princeton, New Jersey: Princeton University Press, pp. 436-437.

RIGBY, J. K, Jr., K. R. NEWMAN, J. S. S. VAN DER KAARS, R. E. SLOAN, & J. K. RIGBY. 1987. Dinosaurs from the Paleocene part of the Hell Creek Formation, McCone County, Montana. *Palaios*, 2:296-302.

RETALLACK, G. J., & M. D. SPOON. 1987. Ecosystem changes across the Cretaceous-Tertiary boundary in eastern Montana. *In*: P. M. Currie & E. H. Koster (eds.), *Fourth Symposium on Mesozoic Terrestrial Ecosystems*, Short Papers, pp. 193-198.